REMARKS

Claims 1-17 are pending. By this amendment, the specification is amended; claims 8, 9, and 12 are amended; and claim 17 is added. Reconsideration in view of the above amendments and following remarks is respectfully requested.

The drawings were objected to under 37 C.F.R. §1.84(p)(5). The specification has been amended in accordance with the suggestion of the Office Action. It is respectfully noted that reference sign MA appears on page 7, line 17. Accordingly, reconsideration and withdrawal of the objection to the drawings under 37 C.F.R.(p)(5) are respectfully requested.

Claims 1-3, 6, 7, 10, 12 and 14-16 were rejected under 35 U.S.C. §103(a) over Nishi (U.S. Patent 5,243,195) in view of Ferraro et al. The rejection is respectfully traversed.

Claim 1 recites a lithographic projection apparatus including a projection beam illumination system, a first object table for holding a projection beam patterning device, a second object table for a holding a substrate, a projection system, a reference frame, and position detection device including a radiation source mounted on the reference frame, a two-dimensional radiation detector mounted in a fixed position on the reference frame, and a mirroring device mounted on one of the object table that is movable relative to the reference frame as to reflect radiation emitted by the radiation source toward the radiation detector.

Claim 12 recites a method of manufacturing a device including determining a reference position of the an object table relative to a reference frame by emitting radiation from a radiation source mounted on the reference frame toward a mirroring device mounted on the object table, reflecting the radiation, and detecting the reflected radiation in two-dimensional radiation detector mounted in a fixed position on the reference frame.

Claims 15 recites a position detection device including a radiation source mounted on a reference frame, a two-dimensional detector mounted in a fixed position the reference frame

and a mirroring device mounted on a object that is movable relative to the reference frame so as to reflect radiation emitted by the radiation source toward the radiation detector.

Claim 16 recites a method of determining a reference position of a movable object table including emitting radiation from a radiation source mounted on a reference frame toward a mirroring device mounted on the movable object table, reflecting a radiation by the mirroring device, and detecting the reflected radiation in a two-dimensional radiation detector mounted on a fixed position on the reference frame.

Each of independent claims 1, 12, 15, and 16 recites a two-dimensional radiation detector mounted on a fixed position on a reference frame. As shown , for example, in Figure 3 of the instant application and as disclosed, for example, on page 8, lines 26-31, the incident beam 12 is reflected unto a return path that is parallel to but displaced from the incident beam like path and the displacement of the return beam 14, in two-dimensions, is a function of the relative position of the radiation source and the reflector in a plain normal to the incident beam 12. The position of the object table, to which the reflector is mounted, relative to the reference frame, to which the radiation source is mounted, is thus also a function of the displacement of the return beam 14, in two dimensions.

The Office Action on page 3, lines 1-6 states that Nishi discloses three position detection devices IFX, IDY1, and IFY2 including collimated lazer sources in the interferometers, radiation detectors mounted in a fixed position on a reference frame and mirroring devices IMX and IMY mounted an object table that is movable relative to the reference frame so as to reflect a lazier beam emitted by the lazier source toward the radiation detectors.

The Office Action then acknowledges that Nishi does not disclose or suggest a two-dimensional radiation detector but cites Ferraro et al. as teaching a CCD and then concludes

that it would have been obvious to one of ordinary skill in the art to employ a CCD and the projection exposure apparatus of Nishi for various assorted advantages.

It is respectfully submitted that it would have been obvious to one of ordinary skill in the art to provide a CCD to the projection exposure apparatus of Nishi, as allegedly taught by Ferraro et al. There is disclosure or suggestion, absent Applicants, for using a two-dimensional radiation detector mounted in a fixed position on a reference frame.

It is also respectfully submitted that even assuming it would have been obvious to combine Nishi and Ferraro et al., such a combination would not have resulted in the inventions of claims 1, 12, 15 and 16. As discussed above, each of claims 1, 12, 15 and 16 recites a two-dimensional radiation detector mounted on in a fixed position on a reference frame. As clearly shown in Figure 2 of Nishi, the beam provided by the lazer interferometer IFX and reflected by the movable mirror IMX and the beams provided by the interferometers IFY1 and IFY2 as reflected by the movable mirror IMY are clearly one-dimensional, not two-dimensional, as recited in each of clams 1, 12, 15 and 16. Thus the combination of Nishi and Ferraro et al. fail to establish *prima facie* case of obviousness against claims 1, 12, 15 and 16.

Claims 2, 3, 6, 7, 10, 14 and 17 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claims 1, 12, 15 and 16 and for the additional features recited therein.

Reconsideration and withdrawal of the rejection of claims 1-3, 6, 7, 10, 12 and 14-16 under 35 U.S.C. §103(a) over Nishi in view of Ferraro et al. are respectfully requested.

Claims 1-3, 6, 7, 10, 12 and 14-16 were rejected under 25 U.S.C. §103(a) Van Den Brink (U.S. Patent 5,801,832) in view of Ferraro et al. The rejection is respectfully traversed.

The Office Action page 3, paragraph number 4, states that Van Den Brink discloses three position detection devices 73, 74, 75 including radiation detectors 76, 77, 78 mounted in a fixed position on a reference frame.

It is respectfully submitted, however, that Van Den Brink suffers from the deficiencies noted above with respect to Nishi. As clearly shown Figure 5 of Van Den Brink, the beams detected by the detectors 76, 77, 78 of the interferometer units 73, 74, 75 respectfully are one-dimensional beams, not two-dimensional radiation, as recited in each of claims 1, 12, 15 and 16. Accordingly, as discussed above, even assuming it would have been obvious to combine Van Den Brink and Ferraro et al., such a combination would not have resulted in the inventions of claims 1, 12, 15 and 16 and thus the combination of Van Den Brink and Ferraro et al. fails to establish a *prima facie* case of obviousness against those claims.

Claims 2, 3, 6, 7, 10 and 14 recited additional features of the invention and allowable for the same reasons discussed above with respect claims 1, 12, 15 and 16 and for the additional features recited therein.

Reconsideration and withdrawal of the rejection of claims 1-3, 6, 7, 10, 12 and 14-16 under 35 U.S.C. §103(a) over Van Den Brink in view of Ferraro et al. are respectfully requested.

Claims 4, 8 and 9 were rejected under 35 U.S.C. §103(a) over Nishi in view of Ferraro et al. and claim 5 was rejected under 35 U.S.C. §103(a) over Nishi in view of Ferraro et al. and further in view of Gallagher (U.S. Patent 5,811,816). The rejection is respectfully traversed.

Claims 4, 5, 8 and 9 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claims 1, 12, 15 and 16 and for the additional features recited therein.

Reconsideration and withdrawal of the rejection of claims 4, 8 and 9 under 35 U.S.C. §103(a) over Nishi in view of Ferraro et al. and claim 5 under 35 U.S.C. §103(a) over Nishi in view of Ferraro et al. and Gallagher are respectfully requested.

Applicants appreciate the indication that claims 11 and 13 define patentable subject matter. However, in view of the above amendments and remarks, Applicants respectfully submit that all the claims are allowable and that the entire application is in condition for allowance.

Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone listed below.

Respectfully submitted,

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Attachment:
(Appendix pp. 10-12)

JPD:tmt

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please change the specification as follows:

Page 7, the whole paragraph starting in line 14 is changed as follows:

- a radiation or illumination system [LA,] IL for supplying a projeciton beam PB of radiation (e.g. UV or EUV radiation);

Page 7, the whole paragraph starting in line 16 is changed as follows:

- a first object table (mask table) MT provided with a mask holder for holding a mask MA (e.g. a reticle), and connected to first positioning M1, M2 means for accurately postioning the mask with respect to item PL;

Page 7, the whole paragraph starting in line 19 is changed as follows:

- second object table (substrate table) WT proviced with a substrate holder for holding a substrate W (e.g. a resist-coated silicon wafer), and connected to second positioning means P1, P2 for accurately positioning the substrate with respect to item PL;

Page 7, the whole paragraph starting in line 34 is changed as follows:

The beam PB subsequently intercepts the mask MA which is held in a mask holder on a mask table MT. Having passed through the mask MA, the beam PB passes through the lens PL, which fouces the beam PB onto a target portion C of the substrate W. With the aid of the interferometric displacement measuring means IF, the substrate table WT can be moved accurately by the second positioning means PI, P2, e.g. so as to position different target portions C in the path of the beam PB. Similarly, the first positioning means M1, M2 and interferometric displacement measuring means can be used to accurately position the mask MA with respect to the path of the beam PB, e.g. after mechanical retrieval of the mask MA from a mask library. In general, movement of the object tables MT, WT will be realized with

the air of a long stroke module ([course] coarse positioning) and a short stroke module (fine positioning), which are not explicityly depicted in Figure 1.

Page 9, the whole paragraph starting in line 20 is changed as follows:

Figure 3 is a partial cross-sectioned view of one position detection apparatus 10. As can there be seen the radiation source 11 and radiation detector 15 are mounted via bracket 16 to the metrology frame MF at such a position that the incident and return beams 12, 14 are inclined at an angle δ to the X-Y plane, to which the wafer W is substantially parallel. Angle δ is preferably substantially [45E] 45 degrees so that horizontal and vertical displacements of the reflector 13 relative to the incident light beam 12 of equal magnitude result in equal displacement of the return light beam 14 on the radiation detector 15.

Page 10, the whole paragraph starting in line 6 is changed as follows:

An alternative form of retro-reflector [13N] 13' known as a cat's-eye, is shown in Figure 5. This is useable in place of the corner cube retro-reflector 13. The cat's-eye [13N] 13' comprises a lens 131 and a mirror 132 placed at a distance for the lens 131 equal to its focal length, f. Conveniently, the lens 131 is formed in the carved front surface of a single transparent body 133 which has a plane rear surface 134 that is selectively silvered to form mirror 132.

See the attached Appendix for the changes made to effect the above paragraph

IN THE CLAIMS:

Claims 8, 9 and 12 are amended as follows:

8. (Twice Amended) Apparatus according to claim [1] 4 wherein said retro-reflector comprises a trapezoid form of a material transparent to said radiation and having three mutually perpendicular surfaces meeting at a corner, said three surfaces being provided with a reflective coating.

9. (Twice Amended) Apparatus according to claim [1] 4 wherein said retro-reflector comprises a convergent lens and a reflective surface, said reflective surface being spaced a distance from said lens equal to the focal length of said lens.

12. (Twice Amended) A method of manufacturing a device comprising:

providing a substrate provided with a radiation-sensitive layer to [a second] an object table;

providing a projection beam of radiation using an illumination system;

patterning the projection beam to form a pattern in its cross section; and

projecting the patterned beam onto said target portions of said substrate;

determining a reference position of [one of] said object [tables] table relative to a reference frame by:

emitting radiation from a radiation source mounted on said reference frame toward a mirroring device mounted on said [one] object table;

reflecting the radiation; and

detecting the reflected radiation in a two-dimensional radiation detector mounted in a fixed position on said reference frame.

Claim 17 is added.

End of Appendix